NORTH CAROLINA DIVISION OF AIR QUALITY

Pre-Construction Review and Preliminary Determination

Permit Issue Date:

Region: Winston-Salem Regional Office
County: Rockingham
NC Facility ID: 7900156
Inspector's Name: Robert Barker
Date of Last Inspection: 09/19/2014
Compliance Code: 3 / Compliance - inspection

Facility Data

Applicant (Facility's Name): Duke Energy Carolinas, LLC-Rockingham Co Comb. Turb.

Facility Address:
Duke Energy Carolinas, LLC-Rockingham Co Comb. Turb.
240 Ernest Drive
Reidsville, NC 27320

SIC: 4911 / Electric Services
NAICS: 221112 / Fossil Fuel Electric Power Generation

Facility Classification: Before: Title V **After:** Title V
Fee Classification: Before: Title V **After:** Title V

Permit Applicability (this application only)

SIP: 02D .0530
NSPS: NA
NESHAP: NA
PSD: 02D .0530
PSD Avoidance: NA
NC Toxics: NA
112(r): NA
Other: NA

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Dana Newcomb Senior Environmental Professional (336) 635-3186 864 South Edgewood Road Eden, NC 27288	Lawrence Sparks General Manager (336) 635-3080 864 South Edgewood Road Eden, NC 27288	Cynthia Winston Mgr.- Permitting & Compliance, Carolinas (919) 546-5538 410 South Wilmington Street Raleigh, NC 27601

Application Data

Application Number: 7900156.14A
Date Received: 12/12/2014
Application Type: Modification
Application Schedule: PSD

Existing Permit Data

Existing Permit Number: 08731/T14
Existing Permit Issue Date: 11/16/2015
Existing Permit Expiration Date: 10/31/2020

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP
2014	1.62	67.14	2.79	39.28	5.22	1.41	0.9443 [Formaldehyde]
2013	0.1110	73.51	3.51	49.88	5.32	1.65	1.18 [Formaldehyde]
2012	2.28	195.07	8.62	120.33	13.32	4.00	2.84 [Formaldehyde]
2011	1.60	108.44	5.13	71.39	8.19	2.35	1.66 [Formaldehyde]
2010	1.40	101.83	5.24	72.33	8.25	2.41	1.70 [Formaldehyde]

Review Engineer: Edward L Martin

Review Engineer's Signature: **Date:** 02/01/2016

DRAFT FOR NOTICE

Comments / Recommendations:

Issue 08731/T15
Permit Issue Date:
Permit Expiration Date:

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1. Introduction

Duke Energy Carolinas, LLC (Duke) submitted to the North Carolina Division of Air Quality (NCDAQ) a Prevention of Significant Deterioration (PSD) permit application (7900156.14A) proposing an alternative Best Available Control Technology (BACT) emission limit for nitrogen oxides (NOx) for the five existing Siemens Westinghouse W501F combustion turbines at the Rockingham County Combustion Turbine Facility. The facility was originally constructed and operated by Dynegy, Inc. and was first issued an air permit on June 30, 1999. The facility began commercial operation in 2000 and was purchased by Duke Energy in 2006. The facility is located approximately 7 miles west of Reidsville, Rockingham County, North Carolina on Highway 65. It operates under the current air permit No. 08731T13.

Duke is requesting an alternative NOx BACT emission limit of 25 ppmvd at 15% O_2 (1-hour average) for up to 2000 hours per year during cold weather conditions when firing natural gas.

The application was deemed "complete" for PSD as of December 12, 2014. NC Division of Air Quality (NCDAQ) will process the application using the procedure in 15A NCAC 02Q .0501(d)(1), satisfying the permitting requirements in both 15A NCAC 02D .0530 "Prevention of Significant Deterioration" and 2Q .0500 "Title V Procedures".

<u>Chronology (see Appendix D for correspondence)</u>

April 21, 2014	Air Quality Analysis Branch (AQAB) (Tom Anderson) contacted the Federal Land Managers for all Class 1 Areas within 300 kilometers of the project, and sent the PSD pre-application checklist, to request whether they had an interest in receiving any additional information for the project.
May 15, 2014	In response to the request to the FLMs to determine interest or noninterest, email from Tom Anderson/FLM stating they would not request a Class I analysis based on worst case emissions until more refined emissions become available for re-evaluation.
December 1, 2014	Modeling protocol was approved (see NCDAQ letter from Tom Anderson of the AQAB to Cynthia Winston at Duke).
December 12, 2014	Application received.
January 12, 2015	Application deemed complete as of December 12, 2014 for review purposes pursuant to 40 CFR 51.166(q)(1) and 15A NCAC 2D .0530(o).
March 6, 2015	Application sent to EPA.
April 14, 2015	Modeling review for 1-hour NO_2 NAAQS completed – see AQAB memo from Tom Anderson to Ed Martin.
April 29, 2015	EPA's comments on the application were received from Stan Krivo (sent via email to Tom Anderson).
June 11, 2015	Sent letter to Bill Jackson (James River Face is nearest Class I area) with copy of application.
July 20, 2015	Sent email to Bill Jackson to inquire if he needed anything further since had not heard back from letter on June 11, 2015. He responded that he had not seen the June 11, 2015 letter with application and that Melanie Pitrolo was now the FLM for James River Face.
July 20, 2015	Melanie Pitrolo requested the hourly NOx emissions increase for the project.
July 21, 2015	Sent Ms. Pitrolo the worst case total increase of 359 lb/hr for all five turbines.
July 30, 2015	Ms. Pitrolo asked what the anticipated consecutive hours of operation would be at the higher NOx limit and whether there would be anything in the permit to limit hours per day.
August 3, 2015	Melanie Pitrolo was advised that NCDAQ did not feel there needed to be a limit on the number of hours Rockingham could operate at the proposed 25 ppm NOx rate since a Class I visibility analysis was originally performed for fuel oil at 42 ppm in 1999.
August 7, 2015	Melanie Pitrolo responded that she was unaware of the AQRV analysis that had been conducted in 1999 at the higher NOx limitation of 42 ppm and therefore the Forest Service would not be requesting any additional analysis.
September 8, 2015	Email from Ed Martin to Cynthia Winston requesting changes to the application.
October 1, 2015	Letter from Lawrence Sparks (Rockingham Station Manager) amending the application.
September 29, 2015	Requested additional cost information for BACT analysis in email from Ed Martin to Cynthia Winston.

October 7, 2015	Received additional cost information for BACT analysis in email from Cynthia Winston to Ed Martin. Duke asked if the BACT option for complete turbine replacement could be removed from the application.
November 10, 2015	Email from Ed Martin to Cynthia Winston stating the BACT option for complete replacement of the turbines is outside the scope of the BACT analysis. Also, requested the reason why NSPS Subpart KKKK does not apply.
November 13, 2015	Email from Lawrence Sparks to Ed Martin amending the application to remove the BACT option for complete replacement of the turbines. Also, stated the reasons why NSPS Subpart KKKK does not apply.
November 19, 2015	Email from Ed Martin to Cynthia Winston requesting a complete economic evaluation for replacing the DLN combustors. Also, NCDAQ questions the rationale for the need to request up to 2,000 hours per year for a NOx limit of 25 ppm at ambient temperatures less than or equal to 32 F when firing natural gas.
December 1, 2015	Email from Larry Sparks to Ed Martin providing the cost analysis and explanation of why the 2,000 hours per year for a NOx limit of 25 ppm was requested.

2.0 Area Description

2.1 Site Description

The Rockingham County Generating Station is located in Reidsville, North Carolina. The approximate Universal Transverse Mercator (UTM) coordinates of the plant are Zone 17, 605.0 km East and 4,021.3 km North, at an elevation of approximately 800 feet above mean sea level. Figure 2-1 displays the plant site location, and Figure 2-2 displays the plant site through an aerial overview of the operations. The Reidsville area is located in the upper piedmont region of North Carolina, approximately 25 miles north of Greensboro. The terrain surrounding the site can be described as gently rolling.

The Class I areas within 200 kilometers of the Rockingham County Generating Station are the Linville Gorge Wilderness Area and the James River Face Wilderness Area (VA). These Class I areas are located approximately 190 kilometers and 140 kilometers from the site, respectively.

Figure 2-1. Duke Energy Progress Rockingham Station Location

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User

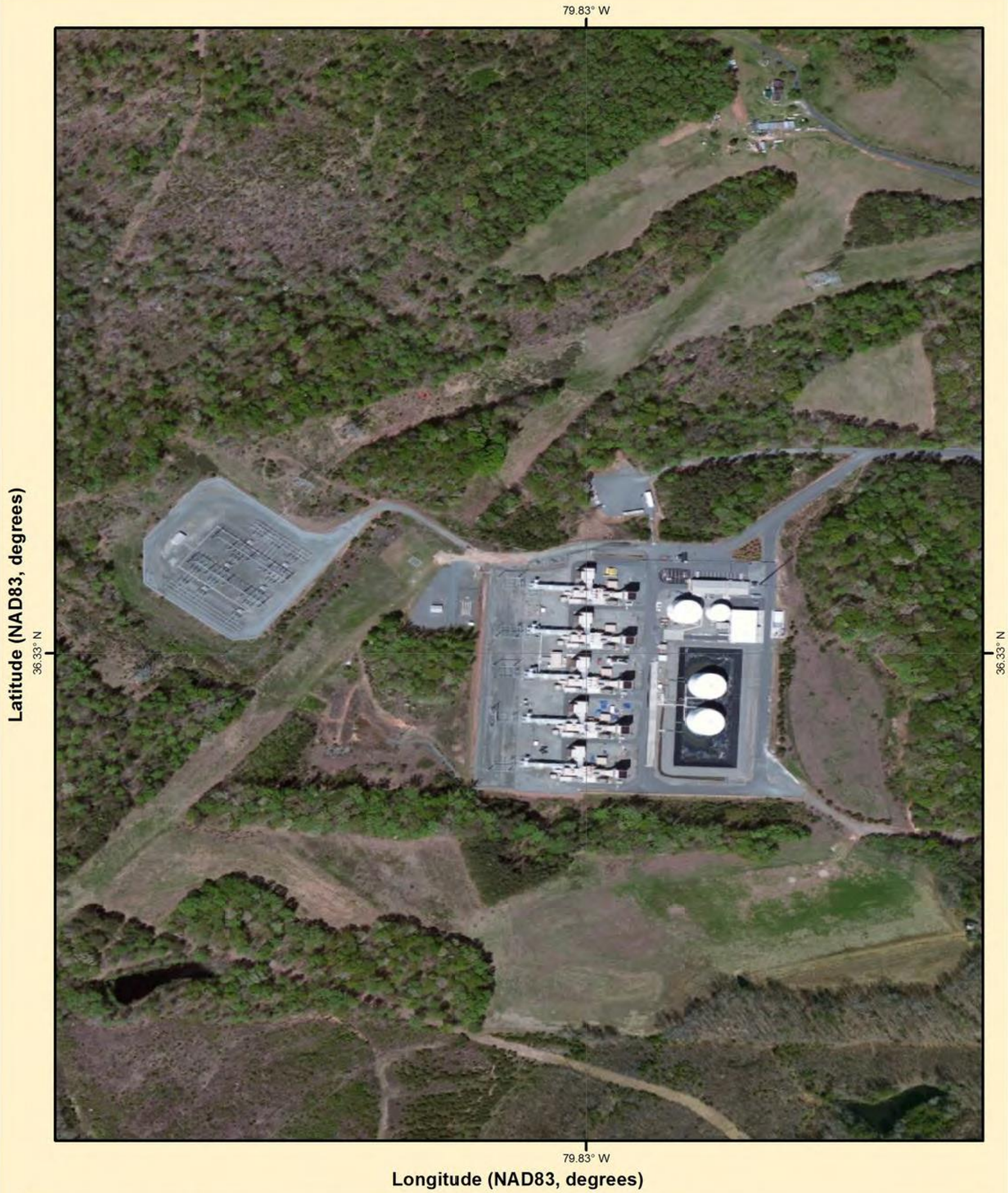

Figure 2-2. Duke Energy Progress Rockingham Station Site Layout and Aerial View

0 0.05 0.1 0.2 Kilometers

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Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

2.2 Attainment Status of Area

The Duke Energy facility is located in Rockingham County. The current Section 107 attainment status designations for areas within the state of North Carolina are summarized in 40 CFR 81.344. Rockingham County is classified as “better than national standards” for total suspended particulates (TSP, also referred to as Particulate Matter, PM), the annual nitrogen dioxide (NO_2) standard, and for the 1971 sulfur dioxide (SO_2) NAAQS. Rockingham County is designated as “unclassifiable/attainment” for carbon monoxide (CO), particulate matter less than 10 microns (PM10) and less than 2.5 microns (PM2.5), lead, 1-hour NO_2, and ozone. Designations for the 2010 SO_2 standards are being addressed in separate future actions. Therefore, the Rockingham County Generating Station is not located in an area currently designated as “nonattainment” for any pollutant regulated under the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) is the applicable regulatory program for major new source review.

3.0 Project Description

3.1 Existing Operations

The Rockingham County Combustion Turbine facility is comprised of five (5) Siemens Westinghouse W501F (which is now called SGT6-5000F) simple cycle combustion turbines (ES-CT-1 through ES-CT-5) that are capable of combusting either natural gas or No. 2 fuel oil. Each unit is rated at 1,875 mmBtu per hour (mmBtu/hr) when firing natural gas or 1,839 mmBtu/hr when combusting No. 2 fuel oil. These heat input rates are equivalent to approximately 180 MW of gross electrical output. The site also includes other ancillary sources (i.e., emergency generators and storage tanks) to support the operation of the combustion turbines. The combustion turbines function as “peaking” capacity to meet the electric system demands during periods of high customer use and are critical to meeting demand during cold weather. Each combustion turbine is limited to 3000 full load equivalent hours per rolling consecutive 12-month period and limited to no more than 1000 full load equivalent hours per rolling consecutive 12-month period when firing No. 2 fuel oil. Emissions are currently limited by restricting the annual hours of operation of the turbines, using dry low NOx (DLN) burners and water injection.

3.2 Proposed Modification

At typical ambient temperatures (greater than 32° F), the facility can meet the current NOx best available control technology (BACT) emission limitation for gas firing of 15 ppmvd corrected to 15% oxygen. However, as the ambient air temperature drops, the density of the air increases, which results in more air mass (and subsequently fuel mass) moving through the units. Because the burners are a lean pre-mix design, ensuring that proper ratios of air and fuel are achieved is integral to proper combustion. If the mixture is too lean then the flame extinguishes and rich mixtures cause flash back towards the pilot flame. The air is compressed to a 19:1 compression ratio, which further narrows the available window for ensuring proper combustion.

Each time this flame extinguishes or flashes back, the combustion “plane” becomes unstable and causes pressure pulses throughout the combustion section of the unit. These pulses are also known as “frequency dynamics” within the unit. As the dynamics increase, the stresses on the equipment increase exponentially and ultimately result in physical damage. In order to prevent damage to the combustion turbines from these dynamics issues, the units must be tuned. However, at the same time, this results in increases in NOx emissions, which during cold weather conditions, exceeds the current 15 ppmvd NOx limit.

To ensure that the equipment is in top working order, the facility has replaced combustion related parts and it has worked with three companies to optimize tuning of the units (Siemens, PSM, and Mitsubishi), yet the equipment is not capable of meeting the current NOx emission limitations for natural gas firing during cold weather conditions.

As the mass of air and water is increased through the unit, the amount of water required to be injected with the pilot flame also increases. The water serves to cool the combustion temperature, thereby lowering the amount of thermal NOx generated. However, when water injection rates are greater than 7 gallons per minute there are diminishing returns on the amount of NOx that is controlled. The additional water also increases the potential for lean combustion conditions, which can ultimately create additional combustion dynamics issues.

Duke is requesting an alternative BACT NOx emission limit of 25 ppmvd at 15% O_2 for up to 2,000 hours per year, to accommodate for the increased NOx emissions during cold weather conditions when firing natural gas. Specifically, the facility is asking that NOx emissions be limited to 25 ppmvd corrected to 15% oxygen when ambient temperatures are at 32° F or below. Duke believes that this change is necessary to ensure that the units are safely operated and physical damage resulting from dynamics issues is minimized during cold weather operation.

<u>Adjustment from 2000 hours to 500 hours per year</u>
NCDAQ questioned Duke (November 19, 2015 email from Ed Martin to Cynthia Winston) regarding the rationale for the need to request up to 2,000 hours per year for a NOx limit of 25 ppm at ambient temperatures less than or equal to 32ºF when firing natural gas, since it appears, based on the last five years of operating data, that the average annual capacity factor for the five turbines is approximately 6.8%. It is assumed most of this is when burning natural gas. Therefore, it would take over three years of typical operation at <u>any</u> ambient temperature to reach 2,000 hours. The maximum capacity factor for any year for any turbine is 13.7%.

Duke responded (December 1, 2015 email from Larry Sparks to Ed Martin) that they understand the concern being raised by NCDAQ. They explain that they did not request a limit on the number of hours that the facility may use the requested 25 ppmvd alternative operating limit in the application because of the uncertainty in predicting weather conditions and the demands of the electrical grid. The Rockingham facility is generally operated as a peaking facility, which means that the facility primarily operates during extreme temperature variations (hot and cold) to meet short term demands of the electrical grid. The application used a worst case assumption that all 2,000 operating hours per year could be at the alternative operating limit. Meteorological data from the Greensboro airport for 2010-2014 was used that indicated each year averages approximately 600 hours where the ambient temperatures are less than 32ºF. If a maximum number of hours is needed to implement the alternative operating scenario, Duke requested that NCDAQ consider a limit of 500 hours per year per turbine to apply the alternative operating scenario.

Based on the above, NCDAQ does not feel the requested 2,000 hours per year are warranted at temperatures below 32ºF and has reduced the alternate limit to no more than 500 hours per year as proposed in the draft permit.

3.3 Project Emissions

The calculations below are based on the proposed limit of 500 hours per year at 25 ppmvd.

The current potential NOx emissions from the combustion turbines (ES-CT-1 through ES-CT-5) when burning natural gas at 15 ppmvd for 500 hours per year are based on the hourly emission rate limit of 104 lb/hr (0.0575 lb/mmBtu) at ISO standard conditions as included in Section 2.1.A.3.a.i of the current permit (T14). The 104 lb/hr emission rate was taken from the original turbine vendor's performance data (see Siemens Westinghouse expected combustion turbine performance sheet in Appendix C). This results in total pre-project (baseline) annual potential NOx emissions of:

104 lb/hr x 500 hr/yr x 1/2000 lb/ton x 5 turbines = 130 TPY

The hourly potential NOx emission rate from each combustion turbine (ES-CT-1 through ES-CT-5) when burning natural gas at the proposed 25 ppmvd NOx emission rate is prorated from the current 104 lb/hr at 15 ppmvd to 25 ppmvd as follows:

104 lb/hr x (25 ppmvd/15 ppmvd) = 173.3 lb/hr

And therefore the potential post-project annual NOx emission rate at 25 ppmvd for up to 500 hours per year is:

173.3 lb/hr x 500 hr/yr x 1/2000 lb/ton x 5 turbines = 216.7 TPY

Duke is not requesting a change to the annual NOx BACT limit of 1255 TPY as shown in Section 2.1.A.3.a.ii of the current permit. This annual limit is based on the worst case of 1000 hours per year operation on fuel oil and 2000 hours per year on natural gas, at 100% load and ISO standard ambient conditions. Therefore annual potential emissions are not increasing. This project will only result in an increase in the maximum short term emission rate while firing natural gas during cold weather conditions.

Note, the 179.9 lb/hr NOx emission rate as shown in Table D-1 of the application is not the correct rate of emissions to use as the new limit corresponding to 25 ppmvd. The 179.9 lb/hr was based on the permit limit of 0.0575 lb/mmBtu (at 15 ppm and ISO conditions of 59 ºF ambient temperature) and a maximum heat input of 1875 Btu/hr, which is at a worst-case 45.4 ºF ambient temperature (see Siemens data sheet in Appendix C) then prorated to 25 ppm as follows:

1875 Btu/hr x 0.0575 lb/mmBtu x (25 ppm/15 ppm) = 179.7 lb/hr.

However, when the permit was first written, the 0.0575 lb/mmBtu was determined based on the NOx emission rate of 104 lb/hr (at ISO conditions) and the heat input of 1810 mmBtu/hr corresponding to the ISO conditions:

104 lb/hr x 1/1810 mmBtu/hr = 0.0575 lb/mmBtu

The 104 lb/hr NOx emission rate was put in the permit at ISO conditions (59 ºF) for 15 ppmvd and is the correct rate to use to prorate up to 25 ppmvd to get 173.3 lb/hr (corresponding to 866.7 TPY). A heat input of 1875 mmBtu/hr was put in the permit as the maximum heat input of any case provided by Siemens, but should not be used to prorate from 15 to 25 ppmvd to get 179.7 lb/hr.

Startup and shutdown emissions

Startup and shutdown emissions are already allowed at NOx levels above 25 ppmvd in section 2.1.A.3.a.i.(A) of the permit. The permit allows NOx emissions not to exceed 60 ppmvd below 55% load and not to exceed 42 ppmvd between 55% and 70% load. This startup/shutdown provision was placed in R03 of the permit on May 10, 2002, based on startup testing and modeling (report received October 29, 2001) for permit R03 for the 60 ppmvd level (29.2 g/s per turbine) corresponding to the 55% load (82.84 MW) worst case startup test emission rate of 20.3 g/s at 41.2 ppmvd (i.e.: 20.3 g/s x (60 ppmvd/41.2 ppmvd) = 29.2 g/s) to show compliance with the annual NAAQS (the only averaging time for the NOx NAAQS at that time). Compliance with the 1-hr NAAQS is addressed in Section 6.0.

3.4 Additional Permit Modification Request

Duke has requested a change to the following permit condition (2.1.A.3.a.i.(A)), which specifies the BACT NOx limits and load conditions for which the limits apply during startup, shutdown or malfunction; as it is unusual to have a numerical emission limitation for periods of malfunction:

> *Emissions resulting from startup, shutdown or malfunction above the short term BACT limits are permitted during operation below 70% load provided that optimal operational practices are adhered to and periods of excess emissions are minimized. Emissions of NOx may not exceed 60 ppmvd below 55% load and may not exceed 42 ppmvd between 55% and 70% load.*

Duke's position is that malfunctions were not intended to be included in the permit condition with a numerical emission limit given their unknown and unpredictable nature. NCDAQ agrees with Duke in that these numerical permit limits were only intended to address emissions resulting from startup and shutdown. During the evolution of permitting, malfunctions were inadvertently included under these limits as well. A version of the current SSM condition (shown above) was initially placed in permit No. 08731R02 issued June 5, 2001. However, that version did not contain any numerical limits for NOx emissions, and only allowed a two-hour per any 24-hour period exemption from excess NOx BACT emissions during SSM provided that optimal operational practices were adhered to and periods of excess emissions were minimized. When the numerical NOx limits (60 ppmvd and 42 ppmvd) were added to the condition in permit No. 08731R03, the condition language should have been changed to remove the applicability of the condition to malfunctions.

Therefore, the condition is being revised as follows to apply the numerical limits during only startup and shutdown and allow the facility to apply optimal operational practices to minimize emissions during malfunctions in combination with the NSPS excess emission requirements:

> *Emissions above the short term BACT limits in Section 2.1.A.3.a.i are permitted during startup and shutdown when operating below 70% load and during malfunction conditions provided that optimal operational practices are adhered to and periods of excess emissions are minimized. During periods of startup and shutdown, emissions of nitrogen oxides shall not exceed 60 ppmvd below 55% load and shall not exceed 42 ppmvd between 55% and 70% load. During periods of malfunction, the NSPS requirements of Section 2.1.A.2.e.ii apply for excess emissions of nitrogen oxides.*

4.0 Regulatory Analysis

The following discussion pertains to the regulatory requirements that must be met for the proposed modification of the Rockingham Combustion Turbine facility. These requirements include both PSD regulations and other State air quality regulations.

15A NCAC 02D .0521 - Control of Visible Emissions
The intent of this Rule is to prevent, abate and control emissions generated from fuel burning operations and industrial processes where an emission can be reasonably expected to occur, except during startup, shutdowns, and malfunctions approved as such according to procedures approved under 15A NCAC 2D .0535.

Visible emissions from these sources shall not be more than 20 percent opacity when averaged over a six-minute period. However, six-minute averaging periods may exceed 20 percent opacity not more than once in any hour and not more than four times in any 24-hour period. In no event shall the six-minute average exceed 87 percent opacity.

15A NCAC 02D .0524 - New Source Performance Standards
The provisions of 40 CFR 60 Subpart GG "Standards of Performance for Stationary Gas Turbines" are applicable to any stationary gas turbine with a heat input at peak load equal to or greater than 10.7 gigajoules (10 million Btu) per hour, based on the lower heating value of the fuel fired, if it commences construction, modification, or reconstruction after October 3, 1977. Subpart GG was last revised on July 8, 2004 (69 FR 41346).

These simple cycle combustion turbines are subject to the requirements in Subpart GG. The Subpart GG limits apply to emissions of nitrogen oxides and sulfur dioxide as shown in the permit. All applicable requirements (emissions standards, testing, monitoring, record keeping, and reporting) in Subpart GG have been included in the current permit.

One consideration is whether the change would be a "modification" under NSPS and make the turbines subject to the more recent Subpart KKKK "Standards of Performance for Stationary Combustion Turbines", 71 FR 38482, July 6, 2006. Subpart KKKK 60.4305 states "If you are the owner or operator of a stationary combustion turbine with a heat input at peak load equal to or greater than 10.7 gigajoules (10 mmBtu) per hour, based on the higher heating value of the fuel, which commenced construction, modification, or reconstruction after February 18, 2005, your turbine is subject to this subpart." The NSPS provision in §60.14 defines "modification" as "any physical or operational change to an existing facility which results in an increase in the emission rate to the atmosphere of any pollutant to which a standard applies". The increase in emission rate is to be evaluated on an hourly basis (e.g. kg/hr or lb/hr.). The increase in NOx emissions for this modification from 15 ppm to 25 ppm is an hourly rate increase when burning natural gas.

Duke's application (page 4-2) states that "Because the combustion turbines at the Duke Energy Rockingham County Facility have not been modified or reconstructed since February 18, 2005, these combustion turbines are not subject to NSPS Subpart KKKK." Duke was asked to explain the reason why Subpart KKKK does not apply in an email of November 10, 2015, from Ed Martin to Cynthia Winston, requesting an explanation of why this change would not be a modification for the hourly increase in NOx emissions under 40 CFR 60.14; and, if there are any "fixed capital costs" associated with this change, to explain why the change would not be a reconstruction under 40 CFR 60.15. Duke replied in an email dated November 13, 2015, from Lawrence Sparks (Responsible Official) to Ed Martin, that the application does not include any physical changes or changes in methods of operation of the combustion turbines, and that there are no fixed capital costs associated with the changes. Therefore, because neither the "modification" or "reconstruction" provisions are triggered, the proposed changes to the existing turbines do not make them subject to Subpart KKKK, and they remain subject to Subpart GG.

15A NCAC 02D .0530 - Prevention of Significant Deterioration

The basic goal of the PSD regulations is to ensure that the air quality in clean (i.e. attainment) areas does not significantly deteriorate while maintaining a margin for future industrial growth. The PSD regulations focus on industrial facilities, both new and modified, that create large increases in the emission of certain pollutants.

Under PSD requirements, all major new or modified stationary sources of air pollutants as defined in Section 169 of the Federal Clean Air Act (CAA) must be reviewed and permitted prior to construction by EPA or permitting authority, as applicable, in accordance with Section 165 of CAA. A "major stationary source" is defined as any one of 28 named source categories, which emits or has a potential to emit (PTE) 100 tons per year of any regulated pollutant, or any other stationary source, which emits or has the potential to emit 250 tons per year of any PSD regulated pollutant.

Pursuant to the Federal Register notice (47 FR 7836) on February 23, 1982, North Carolina (NC) has full authority from the Environmental Protection Agency (EPA) to implement the PSD regulations in the State effective May 25, 1982. Accordingly, the NCDAQ will conduct a full PSD review and process the PSD permit application for the proposed project. NC's State Implementation Plan (SIP) - approved PSD regulations have been codified in 15A NCAC 2D .0530, which implement the requirements of 40 CFR 51.166.

The Rockingham facility is an existing PSD major stationary source. It emits or has the potential to emit 100 tons per year of PM, $PM_{10,}$ $PM_{2.5,}$ SO_2, NO_x, CO, VOC and GHG. It has been classified under the category of "fossil fuel-fired steam electric plants of more than 250 million Btu per hour heat input".

Because the existing facility is considered a major stationary source, any physical change or a change in the method of operation as calculated pursuant to 40 CFR 51.166(a)(7)(iv) which results in a *net emissions increase* for regulated pollutants in the amounts equal or greater than the significance levels, is subject to PSD review and must meet certain review requirements. Thus, the net emission increase as a result of this modification must be compared to the "significance levels" as listed in 40 CFR 51.166(b)(23)(i) to determine which pollutants must undergo PSD review.

Facilities classified as major for PSD and applying for a significant modification are subject to all the requirements as defined in 40 CFR 51.166. These requirements include:

- A demonstration that the BACT is applied to each emission unit that will emit any PSD regulated pollutant above the significant threshold, including a demonstration that emissions of air toxics will not exceed the acceptable ambient levels (AAL's) as regulated by the NCDAQ.

- A demonstration that neither allowable PSD ambient air increments nor NAAQS will be violated as a result of emissions from the proposed project.

- A demonstration that emissions from the proposed project will neither cause adverse impacts to soils and vegetation nor cause degradation of visibility, and that economic growth associated with the project will not cause a significant increase in regional air pollutant levels.

- A demonstration that air emissions resulting from the proposed facility will not adversely impact any PSD Class I area.

The Permittee has performed a PSD applicability analysis for the project for determination of whether the project results in an emission increase of any regulated NSR pollutant above the applicable significance thresholds.

Using the "actual-to-projected actual applicability test" for projects that involve existing emissions units in accordance with 40 CFR 51.166(a)(7)(iv)(*c*), Duke has performed calculations for actual (pre-change) and projected actual (post-change) emissions for NOx.

Baseline actual emissions are determined in accordance with rule 15A NCAC 2D .0530(b)(1)(A) which specifies that baseline actual emissions means the average rate, in tons per year, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the five year period immediately preceding the date that a complete permit application. Also the rule specifies that a different look-back period not to exceed 10 years immediately preceding the date of the receipt of the complete application can be allowed if the permittee can demonstrate that it is more representative of normal source operation. Duke determined NOx baseline actual emissions to be 151.8 tons per year using calendar years 2011 and 2012 as the 24-month period baseline period, which is within the five year period immediately preceding the date of complete application, as shown below.

Projected actual emissions as shown below (from Section 3.3) were determined in accordance with 40 CFR 51.166 (b)(40) which specifies that projected actual emissions means the maximum annual rate, in tons per year, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the 5 years (12-month period) following the date the unit resumes regular operation after the project. In lieu of using the projected actual emissions, the owner or operator may elect to use the emissions unit's potential to emit, in tons per year. Duke has chosen to use the potential to emit (post-project emissions of 216.7 tons per year) rather than projected actual emissions resulting in a net emissions increase of 64.9 tons per year, as shown below. The net emissions increase are compared to the PSD "significance levels" as shown below. This project results in an emissions increase of NOx and PM-2.5 as shown below. Only emissions of NOx exceed its significant emissions threshold.

Baseline actual NOx emissions data based on AERO Point Source Emissions Database

Calendar Year	NOx Emissions (TPY)	24-month Average (TPY)
2012	195.1	**151.8**
2011	108.4	105.1
2010	101.8	65.3
2009	28.8	36.1
2008	43.3	61.6
2007	79.8	63.5
2006	47.2	31.9
2005	16.5	19.5
2004	22.4	22.3
2003	22.1	–

Projected Actual NOx Emissions

	NOx Emissions (TPY)
Baseline actual emissions	151.8 (2011-2012)
Potential post-project emissions	216.7 (natural gas portion only). See Section 3.3
Net emissions increase	64.9
NOx PSD Significant Emission Rate	40
	PSD Review Triggered? YES

Summary of Project Emissions Increases

	VOC	PM	PM-10	PM-2.5[1]	SO_2	NOx	CO	Lead	CO2e
Project Net Emissions Increases	0	0	0	1.8	0	714.9	0	0	0
PSD Significant Emission Rates	40	25	15	10	40	40	100	0.6	75,000
Major NSR Required?	**NO**	**NO**	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**	**NO**

[1] Secondary PM-2.5 emissions due to increases in NOx emissions are calculated by dividing the project NOx emissions by the region average offset ratio (200 for eastern states).

Any pollutant which is emitted at a rate greater than the significance level must undergo a PSD review. The proposed modification will produce significant emissions of NOx and is therefore subject to PSD review for NOx. Duke performed the following reviews and analysis related to PSD for the emissions of NOx:

1. A BACT determination, including an evaluation of unregulated pollutants such as toxic air pollutants,

2. An Air Quality Impact Analysis including monitoring and air modeling to determine extent and significance of any potential air quality impact, and

3. An Additional Impacts Analysis including effects on soils, vegetation, and visibility.

Duke's application has been reviewed by the NCDAQ, Permitting Section staff, to determine compliance with the requirements of all NCDAQ air pollution regulations and has made a preliminary determination, based on the information submitted, that it complies with all applicable North Carolina air quality regulations including the PSD requirements. Therefore, the attached draft air permit (Appendix A) for the modification described herein, with specific permit conditions and emission limits, is being submitted for public comment. The purpose of the public comment period is to develop a complete record, taking into account all available information, so that NCDAQ can make a fully informed determination of whether this application in fact meets all legal and regulatory requirements.

15A NCAC 02D .1806 - Odorous Emissions (State Enforceable Only)
This rule requires that the facility shall not operate the facility without implementing management practices or installing and operating odor control equipment sufficient to prevent odorous emissions from the facility from causing or contributing to objectionable odors beyond the facility's boundary.

15A NCAC 02D .1111 "Maximum Achievable Control Technology" (MACT)
The Rockingham facility is not a major source hazardous air pollutants (HAPs) (see HAP emissions in Table D-2 of the application); therefore, according to 40 CFR 63.6085, the combustion turbines are not subject to the of provisions of 40 CFR 63, Subpart YYYY "National Emission Standards of for Stationary Combustion Turbines."

40 CFR Part 97 - Cross State Air Pollution Rules (CSAPR) Permit Requirements (Federal-Enforceable Only)
For the five combustion turbines (ID Nos. ES-CT-1, 2, 3, 4 and 5), the Permittee shall comply with all applicable requirements of 40 CFR Part 97, Subpart AAAAA "TR NOx Annual Trading Program", Subpart

BBBBB "TR NOx Ozone Season Trading Program", and Subpart CCCCC "TR SO_2 Group 1 Trading Program".

5.0 BACT Analysis for NOx

Under PSD regulations, the determination of the necessary emission control equipment is developed through a BACT review. BACT is defined, in pertinent part, at 40 CFR 51.166 (b)(12) as:

> *An emissions limitation... based on the maximum degree of reduction for each pollutant... which would be emitted from any proposed major stationary source or major modification which the reviewing authority, on a case-by-case basis, taking into account energy, environment, and economic impacts and other costs, determines is achievable... for control of such a pollutant.*

The BACT requirements are intended to ensure that the control systems incorporated in the design of the proposed facility reflect the latest control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the facility. The EPA developed guidance referred to as “Top-Down” BACT process for PSD applicants for determining BACT. However, NCDAQ does not strictly adhere to EPA's “top-down” guidance. Rather, NCDAQ implements BACT in accordance with the statutory and regulatory language. As such, NCDAQ's BACT conclusions may differ from those of the EPA. Additionally, the BACT analysis must consider the impacts of noncriteria pollutants and unregulated toxic air pollutants, if any are emitted, when making the BACT decision for regulated pollutants. Under the BACT requirements of the PSD regulations, all BACT emission limits must, at a minimum, comply with any applicable standard of performance under 40 CFR Part 60 (New Source Performance Standards) and Part 61 (National Emission Standards for Hazardous Air Pollutants), and the North Carolina State Implementation Plan (SIP).

While the EPA Environmental Appeals Board recognizes the “top-down” for delegated state agencies, this procedure has never undergone rulemaking and as such, the “top-down” process is not binding on fully approved states, including North Carolina. NCDAQ prefers to follow closely the statutory language when making a BACT determination and therefore the BACT determination is based on an evaluation of the statutory factors contained in the definition of BACT in the Clean Air Act.

The BACT determination consists of five basic steps. These are:

1) Identify all control technologies,
2) Eliminate technically infeasible options,
3) Rank remaining control technologies by control efficiencies,
4) Evaluate the most effective controls and document results, and
5) Select BACT

Step one in this approach is a comprehensive listing of control alternatives for each applicable regulated pollutant under evaluation. Available control alternatives are those technologies with practical potential for application on similar or identical sources. **Step two** is a evaluation of technical feasibility with respect to source-specific factors. A demonstration of technical infeasibility is made to eliminate control options based on technical difficulties which would preclude the successful application of the option on the source being reviewed. Technically infeasible alternatives are then eliminated from further BACT analysis. **Step three** ranks the remaining control technologies by control effectiveness, including the control efficiencies (percent of pollutant removed), expected emission rate (tons per year and pounds per hour), expected emission reduction (tons per year), economic impacts (cost effectiveness), environmental impacts (including emission of toxic or hazardous air contaminants), and energy impacts (benefits or disadvantages). **Step four** is a case-by-case evaluation of energy, environmental, and economic impacts. **Step five** requires the selection of the most effective option not rejected as BACT for the emission source.

5.1 Step 1 – Identification of Control Technologies

The gas turbine, generally, is a low emitter of exhaust pollutants because the fuel is burned with ample excess air to ensure complete combustion. The exhaust emissions of concern and the emission control techniques can be divided into several categories as described herein. A review of EPA's RACT/BACT/LAER Clearinghouse (RBLC) on Process Code 15.110 indicates that Dry Low NOx (DLN) Combustion and Selective Catalytic Reduction (SCR), with and without water/steam injection, are common control technologies used to control NOx emissions from larger simple cycle combustion turbines. Other less common NOx control technologies are also discussed herein. A summary of Duke's RBLC search for simple cycle combustion turbines is contained in the application.

Factors affecting NO_x formation include turbine design, ambient conditions, turbine load and fuel type. Two types of NO_x emissions from CTs are of concern: thermal NO_x and fuel NO_x. Thermal NO_x is created by the high temperature reaction of nitrogen and oxygen in the combustion air. Thermal NO_x emissions can be reduced by lowering the peak combustion flame temperature. NO_x formation decreases rapidly for either rich or lean combustion. Therefore, local flame stoichiometry is critical in achieving reductions in NO_x. Fuel NO_x is formed by the reaction of fuel-bound nitrogen compounds with oxygen. Natural gas has negligible chemically-bound nitrogen (although some molecular nitrogen is present) and fuel NO_x emissions in combustion turbines are inherently negligible when firing natural gas. Thus, essentially, all NO_x formed from natural gas combustion is thermal NOx. The Rockingham turbines are currently equipped with dual-fuel dry low-NO_X combustors and water injection for NO_X control.

Techniques used to reduce NO_x formation for combustion turbines during the combustion process are deemed as "combustion controls." Techniques applied downstream of the combustion zone, after NO_x formation, to reduce NO_x emissions are called as "post-combustion controls."

The following candidate NOx emissions control technologies have been evaluated for NOx reduction:

• Rich/Quench/Lean (RQL) Combustion
• Nonselective Catalytic Reduction (NSCR)
• Catalytic Oxidation/Absorption - SCONOx^{TM}
• Flue Gas Recirculation (FGR)
• Catalytic Combustion - XONON^{TM}
• Fuel Switching
• Selective Catalytic Reduction (SCR)
• Dry Low-NOx Combustion Technology (DLN)
• Selective Noncatalytic Reduction (SNCR)

In addition, wet injection is a standard NOx control that is normally used in conjunction with the above control technologies. In wet injection combustion control, either demineralized water or steam is injected into the gas turbine combustion chamber. The moisture acts as a heat sink, reducing the peak flame temperature, thus reducing the formation of thermal NO_x. Equivalent levels of NO_x control are achieved with either water or steam injection. Wet injection is applicable to gas or liquid fuels.

5.2 Step 2 – Technical Feasibility Analysis

The technical feasibility of the candidate NOx emissions control technologies identified in step 1 are discussed below.

<u>Rich/Quench/Lean (RQL) Combustion</u>
Rich/Quench/Lean (RQL) combustors burn fuel-rich in the primary zone and fuel-lean in the secondary zone, and reduce both thermal and fuel NOx. Incomplete combustion under fuel-rich conditions in the primary zone produces an atmosphere with a high concentration of CO and H_2, which replace some of the oxygen for NOx formation and also act as reducing agents for any NOx formed in the primary zone. This control alternative is more effective for fuels with higher fuel-bound nitrogen content in reducing the rate of fuel

NOx formation. Theoretically, this control alternative can be applicable to combustion turbines, but based on information presented in the EPA Alternative Control Techniques (ACT) document ("NOx Emissions from Stationary Gas Turbines," EPA-453/R-93-007), RQL combustors are not commercially available for most turbine designs. Furthermore, there is no known application for simple-cycle turbines in the utility industry. Thus, the control alternative utilizing RQL combustion will be precluded from further consideration in this BACT analysis.

Catalytic Oxidation/Adsorption – SCONOx™

$SCONO_X$™ is a patented process by Goal Line Environmental Technologies that employs post-combustion catalytic absorption to reduce emissions of NO_X and CO. The system uses a catalyst to oxidize CO to CO_2 and NO to NO_2, where the NO_2 is absorbed onto the catalyst surface through the use of a potassium carbonate coating (oxidation/absorption cycle). A dilute hydrogen reducing gas is passed across the catalyst surface in the absence of oxygen and the absorbed NO_2 is released as N_2 and water (regeneration cycle). CO_2 in the regeneration gas reacts with potassium nitrates to form potassium carbonate, which was the coating on the catalyst surface before the oxidation/absorption cycle began, causing the catalyst to be continuously regenerated. Because the regeneration cycle must take place in an oxygen-free environment, a section of catalyst undergoing regeneration must be isolated from the exhaust gas.

This technology is a new and emerging control technology that has been applied for concurrent reductions of NOx, CO, and VOC from an assortment of combustion applications that include mostly turbines, boilers, and lean-burn engines. However, based on available information, this technology has never been applied to simple-cycle combustion turbines. It can operate effectively over a wide operating temperature range of 450-700ºF and it is also capable of operating at temperatures as low as 300ºF. NOx emissions level to 3 ppmvd at 15 percent O_2 has been demonstrated on a 30 MW combined-cycle turbine.

Some of the concerns for application of SCONOx™ to a simple-cycle peaking turbine application is accompanied with the following considerations:

- The technology is not readily adaptable to high-temperature applications outside the 300-700° F range and is susceptible to the thermal cycling that would be experienced at the Rockingham County facility.
- Scale-up is still an issue. The technology has only been demonstrated for smaller gas turbines.
- Optimum SCONOx™ operation is predicated by stable gas flow rates, NOx concentrations, and temperature. The nature of simple cycle/peaking turbine operations does not afford any of these conditions which will significantly impair the effective control efficiency of the SCONOx™ system.
- The K_2CO_3 coating on the catalyst surface is an active chemical reaction and reformulation site which makes it particularly vulnerable to fouling. On some field installations, the coating has been found to be friable and tends to foul in the harsh induct environment. The catalyst is also very sensitive to sulfur from the fuel.
- During the regeneration step, the addition of the flammable reducing gas into the hot flue gas generates the possibility of lower explosive limit exceedances in the event the catalyst isolation is not hermetic or there is a failure in the carrier steam flow.
- Installation cost exceeds the cost of traditional SCR by a factor of 2 to 3.
- This technology produces twice the pressure drop of traditional SCR, increasing fuel and energy costs.

In view of the above limitations, SCONOx™ is not considered technically feasible for the proposed simple-cycle turbine applications at the Rockingham County facility. Thus, this control alternative will be excluded from further consideration in this BACT analysis.

Catalytic Combustion - XONON™

XONON™ is a catalytic post-combustion technology that reduces the production of NOx by using a catalyst in the combustion stage. In a catalytic combustor, the fuel and air are premixed into a fuel-lean mixture and then passed into a catalyst bed. In the bed, the mixture oxidizes without forming a high-temperature flame front, thereby reducing peak combustion temperatures below 2,800°F, which is the temperature at which significant amounts of thermal NOx begin to form. This particular technology has only been tested on smaller combustion turbines (less than 10 MW) and it is not commercially available for larger size utility turbines, such as the ones at the Rockingham County facility. This technology has not been fully demonstrated in practice and is not commercially available for larger combustion turbines. Therefore, XONON^{TM} catalytic combustors are not considered technically feasible and will be precluded from further consideration in this BACT analysis.

Selective Catalytic Reduction (SCR)
SCR is a post-combustion control technology whereby ammonia is injected into the exhaust gas upstream of a catalyst bed, and is normally used in conjunction with other combustion control(s) to achieve a higher degree of control than either technology alone can provide. The ammonia reacts with NO_x in the exhaust gas to form molecular nitrogen and water vapor. Most commercial SCR systems utilize base metal catalysts (vanadium- or titanium-based) and operate over a temperature range of approximately 500-800ºF. A given catalyst achieves effective NO_x control within a 100-200ºF temperature-window. At temperatures outside this window, the catalyst becomes ineffective and NO_x reduction decreases. Excess temperatures can permanently damage the catalyst. Also, at low temperatures unreacted ammonia can "slip" through and be emitted to the atmosphere.

SCR systems have been determined to be LAER and BACT to reduce NO_x emissions for many combined-cycle base-load installations firing natural gas or firing natural gas as the primary fuel with limited hours of fuel oil firing as backup. However, SCR is not readily applicable to large frame utility simple-cycle turbines such as the Siemens Westinghouse W501F at Rockingham due to material temperature limitations, which preclude its application in the high temperature exhaust. High temperature SCR (hot SCR) has only been demonstrated in practice for aeroderivative gas turbines (typically 50 MW or smaller), which have exhaust gas temperatures of 900ºF or less. Hot SCR has not been demonstrated in practice for large frame utility turbines, such as at the Rockingham facility operating in simple-cycle mode with an exhaust temperature of approximately 1100ºF. Therefore, NCDAQ does not consider hot SCR to be technically feasible for reduction of NOx emissions from the natural gas-fired simple-cycle turbines at Rockingham. NCDAQ's search review of EPA's RACT/BACT/LAER Clearinghouse (RBLC) for Process Code 15.110 (large natural gas simple cycle combustion turbines greater than 25 MW) using SCR for at least the last ten years is shown below. Duke's application, Table 5-1, also shows their RBLC search results for the last 10 years for simple-cycle turbines for Process Code 15.110 for all NOx control methods

Recent Simple Cycle Turbine NOx Permits with SCR NOx Control

Date	RBLC ID	Facility Name	NOx Limit (ppm)	Turbines	Size (each)	Basis
10-26-04	FL-0261	Arvah B. Hopkins Gen Station	5	LM6000	50 MW x 2	BACT
7-2-08	CA-1175	Escondido	2.5	unknown	46.5 MW	BACT
12-4-08	CA-1176	Orange Grove	2.5	unknown	49.8 MW	Case-by-Case
9-24-09	NJ-0075	Bayonne	2.5	Rolls Royce	64 MW x 8	LAER
12-11-09	CA-1174	El Cajon	2.5	unknown	49.95 MW	BACT
9-16-10	NJ-0077	Vineland Muni Elec	2.5	Trent 60	64 MW	Case- by-Case
10-27-10	NJ-0076	PSEG Kearny	2.5	LM6000	40 MW x 6	Case-by-Case
8-28-12	WY-0070	Cheyenne Prairie	5	LM6000	40 MW x 3	BACT
11-19-12	CA-1223	Pio Pico	2.5	LMS100	100 MW x 3	BACT
9-16-13	ND-0030	Lonesome Creek	5	LM6000PF	45 MW x 3	BACT
3-5-14	OR-0050	Troutdale Energy	2.5	LMS100	100 MW x 2	BACT

All the above applications of SCR on simple-cycle turbines have been used or to be used (if not yet in operation) for the smaller aeroderivative turbines shown. NCDAQ is not aware of any BACT applications for which hot SCR has been demonstrated in practice for large frame utility simple-cycle turbines such as at Rockingham.

Selective Non-Catalytic Reduction (SNCR)

SNCR is a post-combustion flue gas treatment similar to selective catalytic reduction (SCR) except that instead of using a catalyst, a reducing compound such as ammonia or urea is injected into the exhaust gas to react with and reduce NO_x emissions. SNCR has been used extensively in boiler, heater, and incineration applications. However, it has not been applied to combustion turbines. The flue gas temperatures in the range of 1600-1900ºF are required for optimum performance of this technology. These required temperatures are much more than the exhaust temperature of approximately 1100ºF for the simple cycle combustion turbines. This temperature restriction makes application of this technology impractical as a means of control for NO_x emissions. There are no known applications of SNCR on simple or combined cycle combustion turbines. Therefore, SNCR is not technically feasible and will be excluded from further consideration in this BACT analysis.

Nonselective Catalytic Reduction (NSCR)

Nonselective catalytic reduction (NSCR) technology has been applied successfully to automobiles and stationary reciprocating internal combustion engines. The NSCR process utilizes a platinum/rhodium 3-way catalyst to reduce NOx to nitrogen and water vapor under fuel-rich conditions. Since combustion turbines typically utilize high excess air rates, these units typically operate in fuel-lean conditions. Therefore, because the process must take place in a fuel-rich environment to be successful, NSCR technology is technically infeasible for combustion turbines, and is being excluded from further consideration in this BACT analysis.

Flue Gas Recirculation (FGR)

Flue gas recirculation (FGR) is a NOx emission reduction technique based on recycling 15 to 30 percent of the products of combustion (flue gas) to the primary combustion zone, similar to what is done in a boiler. The recirculation of flue gas dilutes the combustion reactants, reduces the peak flame temperature, and reduces the local oxygen concentrations, thereby inhibiting thermal NOx formation. Several inherent drawbacks limit its potential use with gas-fired simple cycle combustion turbines. Flue gas recirculation requires a relatively large capital investment because of the need for high-temperature fans and ductwork. The low flame temperature and susceptibility to flame instability limits FGR usage in high-temperature applications. Since FGR is believed to have only a small effect on fuel NOx formation, it may not be as effective on gas-fired combustion turbines. Furthermore, due to the dynamic and intermittent operations of natural gas peaking units, balancing of the gas flows and flame stability would be a significant challenge. Since it does not appear that flue gas recirculation has been demonstrated on simple cycle combustion turbines, and based on the reasons above, FGR is technically infeasible and is being excluded from further consideration in the BACT analysis.

Fuel Switching

The Rockingham County facility is permitted to operate up to 2,000 hours per year on natural gas and 1,000 hours per year on fuel oil. However, the facility has only had challenges meeting the NOx emission limits when firing natural gas during cold weather conditions. Switching to fuel oil during cold weather conditions would allow the facility to comply with the NOx emissions standards. However, the emissions from the combustion of fuel oil are inherently higher than emissions from natural gas combustion (42 ppmvd at 15% O_2 vs. 25 ppmvd at 15% O2), therefore fuel switching is not considered further.

Dry Low NOx (DLN) Combustion Technology

DLN combustion technology with water injection is inherent to the design of the gas turbines at the Rockingham facility, and reduces the formation of NO_x through enhanced mixing of combustion fuel and air prior to combustion to reduce the formation of thermal NOx emissions by reducing the combustion temperature. This technology relies on establishing fuel-lean zones within the combustor and staged combustion. The first stage uses a pilot burner for flame stabilization followed by a secondary stage of multiple fuel injection nozzles where a lean pre-mixture of fuel and air are burned in order to assure a uniform mixture and the avoidance of high temperature regions in the combustor. DLN technology in general has been shown to reduce NOx emissions to levels between 9 ppmvd and 25 ppmvd, with newer designs within the past several years reaching the 9 ppmvd level.

The Rockingham County facility was built between 1999 and 2000, and was originally designed to meet an emission limitation of 25 ppmvd at 15% oxygen during normal operations. Siemens projected the DLN combustors would be able to achieve and guarantee a 20 ppmvd emission rate when firing natural gas by April 1, 2001 (after approximately one year of operation) and 15 ppmvd by April 1, 2002 (by the end of the second year of operation) as the turbine operations were refined. The 15 ppmvd emission level was permitted as an "innovative technology" that had not yet been demonstrated at the time that the permit was written. However, during cold weather conditions (below 32ºF), these particular combustion turbines experience low-frequency dynamics issues and a 15 ppmvd NOx level cannot be safely achieved (as discussed in Section 3.2 above).

Siemens has refined the dynamics design issues since the original design and construction of the W501F turbines installed at the Rockingham County facility. In the original application, Duke presented the BACT option of complete replacement of the existing units with modern design ultra-low NOx units; however, in an email dated November 13, 2015, from Lawrence Sparks (Responsible Official), Duke amended the application to remove this option. NCDAQ agrees that a complete replacement of the turbines is outside the scope of a BACT analysis for modification of an existing source. Replacement of the DLN combustors with new DLN combustors is technically feasible; therefore Duke has included a cost analysis for using this alternative.

5.3 Step 3 - Ranking of NOx Control Technologies

The only technically feasible control option for reducing NOx emissions under consideration is replacement of the DLN combustors (with water injection) to control NOx to 9 ppmvd.

5.4 Step 4 – Economic, Environmental and Energy and Impacts

<u>Cost Effectiveness Evaluation</u>
As discussed earlier, the top-down BACT approach requires an economic evaluation of the control options being considered. Duke Energy is proposing to control NOx emissions at 25 ppmvd by utilizing the current DLN combustion technology with water injection, which is the baseline emission rate that will occur without any additional NOx control using the existing DLN combustors. The use of the current control technology does not have any additional cost impacts. Therefore, the cost analysis will focus on the cost effectiveness of replacing the DLN combustors with new DLN combustors, which is the only technically feasible control technology identified in Step 3.

In response to NCDAQ's request (November 19, 2015 email from Ed Martin to Cynthia Winston), Duke provided (December 1, 2015 email from Larry Sparks to Ed Martin) a budgetary quote from Siemens showing a purchase capital estimate (turbine hardware and installation labor) of $8,500,000.00 (in 2014 dollars) to upgrade each of the five turbines with dual fuel ultra-low NOx combustors that can meet a NOx emission rate of 9 ppmvd (at any ambient temperature) and a cost-effectiveness analysis. Duke's cost-effectiveness analysis to replace the combustors includes the total capital cost (purchased equipment, direct and indirect installation costs) estimates, annual operating costs and the total annualized cost in accordance with the methodology presented in EPA's Cost Control Manual, 6th Edition to estimate. Two cases are presented depending on the controlled NOx reference point since the upgraded combustors are capable of reducing NOx to 9 ppmvd, beyond the current permitted limit:

Case 1 From a baseline NOx emission rate of 25 ppmvd (uncontrolled without any additional NOx control) to a controlled rate of 15 ppmvd, which is the current permitted NOx emissions limit.

Case 2 From a baseline NOx emission rate of 25 ppmvd (uncontrolled without any additional NOx control) to a controlled rate of 9 ppmvd, which is the NOx emission rate the upgraded combustors can meet.

The Total Capital Investment is estimated to be $51,447,000, and the total annual cost is estimated to be $10,908,156 for both cases as shown in Table 5-1. The estimated cost-effectiveness of reducing NOx to 15 ppmvd is $125,815 per ton of NOx reduced and the estimated cost-effectiveness of reducing NOx to 9 ppmvd is $78,646 per ton of NOx reduced. Neither estimate is economically feasible.

Table 5-1
Top-down BACT Cost Comparison for NO_x Control*

Control Alternatives	Uncontrolled Baseline NOx Emissions (tons/yr)	Controlled NOx Emissions (tons/yr)	NOx Emissions Reduction (tons/yr)	Total Capital Investment ($)	Annual Cost ($/yr)	Cost-Effectiveness ($/ton)
DLN combustion with water injection at 15 ppmvd	216.7 @ 25 ppmvd**	130 @ 15 ppmvd**	86.7	51,447,000	10,908,156	125,815
DLN combustion with water injection at 9 ppmvd	216.7 @ 25 ppmvd**	78 @ 9 ppmvd***	138.7	51,447,000	10,908,156	78,646

* based on 500 hours per year
** see Section 3.3
*** 130 tons/yr x (9 ppmvd/15 ppmvd) = 78 tons /yr

Therefore, the only economically feasible control option is the use of the existing DLN combustion and water injection technology currently in place, with an alternative short term BACT limit of 25 ppmvd at 15% O_2 during cold weather conditions (below 32°F).

Environmental Impacts
Under the PSD program, NOx is regulated to prevent significant deterioration of air quality due to ozone formation. Ozone is formed in the atmosphere due to the chemical reactions between NOx and VOC emissions in the presence of sunlight. Excessive ambient concentrations of ozone in the lower atmosphere can be injurious to human health and damaging to vegetation. The facility is located in a lightly populated area of North Carolina with ambient concentrations of ozone that are in attainment with the NAAQS. In addition, the modeled increased emissions from the combustion turbines demonstrate compliance with the NO_2 NAAQS.

The environmental impacts of DLN combustion technology are very minimal. There is no hazardous waste generated with the use of this technology, and it does not generate increased levels of hazardous air pollutants or toxic air pollutants. Furthermore, the combustion of natural gas is inherently a more clean process than the combustion of other fuels.

Energy Impacts
There would not be any difference in energy impacts of DLN with water injection between using an upgraded combustor and using the current combustors.

5.5 Step 5 - Proposed BACT for the Five Simple Cycle Combustion Turbines

Results of the top-down BACT analysis indicate that BACT for the five simple cycle combustion turbines is DLN combustion technology with water injection when burning natural gas. As proposed, the Rockingham facility will continue meet the current short-term NOx BACT emission limit of 15 ppmvd at 15% O_2 when burning natural gas when the ambient temperature is greater than 32°F on a 24-hour average basis, and will meet an emission limit of 25 ppmvd at 15% O_2 when burning natural gas when the ambient temperature is less than or equal to 32ºF on a 1-hour average basis for up to 500 full load equivalent hours per rolling consecutive 12-month period for each turbine, except as allowed in Section 2.1.A.3.a.i.(A) of the permit during startup and shutdown.

The current total long-term NOx limit of 1,255 tons per consecutive 12-month period for all five turbines will not change. This limit was, and is, based on a NOx emissions rate of 15 ppmvd when burning natural gas. Since the NOx emission rate is now increased to 25 ppmvd when burning natural gas at a temperature less than or equal to 32ºF, and in order to ensure compliance with the 1,255 limit at this higher rate, the draft permit contains a requirement to report the total long-term annual NOx emissions (tons per rolling consecutive 12-month period) from all turbines. In addition, the draft permit contains a requirement to report the full load equivalent hours of operation per rolling consecutive 12-month period for each turbine when operating at an ambient temperature of less than or equal to 32ºF and firing natural gas.

6.0 Air Quality Ambient Impact Analysis

6.1 PSD Requirements

PSD regulation 40 CFR 51.166 (k) requires an applicant to perform an ambient impact analysis to ensure the following:

1. No National Ambient Air Quality Standard (NAAQS) will be exceeded at any location during any time period where the proposed new source will have a significant impact.

2. The proposed new source, in combination with other increment-affecting sources, will not cause any allowable PSD increment to be exceeded.

PSD regulation 40 CFR 51.166 (m) requires the establishment of ambient air quality in the impact area of the proposed source for all pollutants (including those for which no NAAQS exists) with emissions increases which exceed the PSD significant levels (as defined by 40 CFR 51.166 (b)).

Duke submitted a PSD modeling analysis for the five existing Siemens Westinghouse W501F combustion turbines located at the Rockingham County facility in support of the change to increase the current short term NOx emissions BACT limit from 15 ppmvd to 25 ppmvd when burning natural gas during cold weather conditions. The facility does not propose to change the current annual NOx emission limit, so annual potential emissions do not increase with this project; only short term NOx emissions will increase. Duke's modeling protocol was developed through discussions with NCDAQ to describe the modeling approach to be used to satisfy its compliance demonstration obligations. The protocol was approved as submitted (see NCDAQ letter of December 1, 2014 from Mr. Tom Anderson of the AQAB to Ms. Cynthia Winston at Duke). Because the annual potential emissions of NOx are not increasing and compliance with the annual NO_2 standard was demonstrated when the facility was originally permitted, only the 1-hour NO_2 standard is addressed here.

NOx emissions from each of the five turbines were modeled at 173.3 lb/hr as shown in Section 3.3. Emergency or intermittently used emission sources operating 100 hours per year or less were not modeled for with short term averaging periods, per EPA guidance. The emergency fire water pump and black-start emergency generator engines would be highly unlikely to be operating at the same time as the turbines; therefore, such a situation would not represent a typical worst-case operating scenario.

The PSD modeling analysis described in this section was conducted in accordance with current PSD directives and modeling guidance.

6.2 Class II Preliminary SIL Air Quality Modeling Analysis

An air quality preliminary impact analysis was conducted for NO_2 since it exceeded its applicable significant emission rate of 40 tpy. The modeling results were then compared to North Carolina's proposed 1-hour NOx Significant Impact Level (SIL) of 10 µg/m^3 to determine if a full impact air quality analysis would be required for that pollutant.

<u>Location and Topography</u>
The Duke-Rockingham facility is located near Reidsville, NC, in Rockingham County. The facility area is in the northwestern piedmont region of N.C., in gently rolling terrain, and is generally agricultural, industrial, and forest land. For modeling purposes, the area, including and surrounding the site, is classified rural, based on the land use type scheme established by Auer 1978.

Duke-Rockingham evaluated the pollutant's significant emissions using the EPA AERMOD model and five years (2008-2012) of surface and upper air meteorological data collected at the Greensboro National Weather Service (NWS) station. Full terrain elevations were included, as were normal regulatory defaults. Sufficient receptors were placed in ambient air beginning at the fenceline to establish maximum impacts. Emission rates for this specific project were used and the maximum impacts were then compared to the SIL. Since the results showed impacts above the 1-hour SIL for NO_2, further modeling was required. Only the 1-hour averaging period was evaluated for NO_2 since it is the only averaging period affected by the proposed alternative operating scenario. The SIL results are shown in Table 6-1.

Table 6-1 - Class II Significant Impact Results (10 µg/m^3)

Pollutant	**Averaging Period**	**Facility maximum Impact (10 µg/m^3)**	**Class II Significant Impact Level (10 µg/m^3)**	**Significant Impact Distance (km)**
NO_2	1-hour	**79.4**	10	8.3

6.3 Class II Area Full Impact Air Quality Modeling Analysis

A Class II Area NAAQS analysis was performed for NO_2 to include offsite source emissions and background concentrations. Duke-Rockingham used AERMOD with the modeling methodology as described above. Off-site source inventories for the modeling were obtained from NCDAQ and then refined by Duke-Rockingham using the NCDAQ approved "Q/D=20" guideline. Fourteen offsite sources were used. Those sources, along with their emission rates, are provided in the attachments.

Duke-Rockingham used an appropriate array of receptors beginning at the declared fenceline and extending outward to approximately 25 kilometers. NO_2 background concentrations were obtained from a monitor located in Paulding County, GA since it was judged to be most representative of the rural NO_2 background concentrations for the Rockingham County region. The modeling results are shown in Table 6-2 and indicate compliance with the NAAQS NO_2.

Table 6-2 - Class II Area NAAQS Modeling Results

Pollutant	**Averaging Period**	**Maximum Facility & Offsite Source Impacts (µg/m^3)**	**Background Concentration (µg/m^3)**	**Total Impact (µg/m^3)**	**NAAQS (µg/m^3)**	**% NAAQS**
NO_2	1-hour	152.0	32.0	184	188	98

A CLASS II increment analysis was not required since and an increment value has not yet been established for NO_2 for the 1-hour averaging period.

6.4 Additional Impacts Analysis

Additional impact analyses were conducted for growth, soils and vegetation, and visibility impairment as required by 40 CFR 51.166(o).

Growth Impacts
Duke-Rockingham is not expected to employ any additional personnel as a result of the proposed modification. Therefore, this project is not expected to cause a significant increase in growth in the area.

Soils and Vegetation
The facility is located in the northwestern piedmont of North Carolina. The local geography is gently rolling with a mix of forests, some agricultural crops, and herbaceous vegetation. By way of the NAAQS analyses of this submission, Duke-Rockingham demonstrated that the impacts were below the established standards – both the primary and secondary NAAQS. The impacts were also below EPA established thresholds for soil and vegetation effects (described in detail in Section 6.9.1 of the modeling report). Thus, the Duke-Rockingham project is not expected to cause any detrimental impacts to soils or vegetation in the area.

Class II Visibility Impairment Analysis
A Class II visibility impairment analysis was not conducted since there are not any visibility sensitive areas with the Class II Significant Impact Area (a distance of 8.2 kilometers).

6.5 Class I Area - Additional Requirements

The closest Federal Class I Area to the Duke-Rockingham project is the James River Face Wilderness, which is located at a distance of approximately 140 kilometers from the project area. Initially, on April 21, 2014, prior to receipt of the application, the Federal Land Managers for all Class 1 Areas within 300 kilometers of the project were contacted and none of them required any analysis for their respective jurisdictions; therefore, no analysis was conducted by the applicant. The following FLMs were notified:

- Jill Webster/Meredith Bond – Fish and Wildlife Service – Swanquarter NWR, Cape Romain (in South Carolina) NWR
- Bill Jackson – US Forest Service – Joyce Kilmer-Slickrock NWA, Linville Gorge NWA, Shining Rock NWA, James River Face NWA
- Andrea Stacey – National Parks Service- Great Smokey Mountains NP

Later, on June 11, 2015, a copy of the application with a letter was sent to Bill Jackson, the FLM for the nearest Class I area, the James River Face. When no response was received, on July 20, 2015, an email was sent to Mr. Jackson to inquire if he needed anything further. He responded that he had not seen the June11, 2015 correspondence with the application and that Melanie Pitrolo was now the FLM for James River Face. On July 20, 2015, Ms. Pitrolo requested the hourly NOx emissions increase, and the worst case total increase of 359 lb/hr for all five turbines was provided on July 21, 2015. On July 30, 2015, Ms. Pitrolo asked what the anticipated consecutive hours of operation would be at the higher NOx limit and whether there would be anything in the permit to limit hours per day. On August 3, 2015, Ms. Pitrolo was advised that NCDAQ did not feel there needed to be a limit on the number of hours Rockingham could operate at the proposed 25 ppm NOx rate since a Class I visibility analysis was originally performed for fuel oil at 42 ppm in 1999 (1000 hr/yr) when the first PSD permit was issued and that the proposed 25 ppm limit is much lower than the 42 ppm worst-case short-term permitted emission rate. Further, the facility was original permitted for a 25 ppm NOx emission rate for natural gas for the first year of operation (from startup through April 1, 2001), then 15 ppm for one more year, and finally to the current 15 ppm from that point on, and the Class I analysis was based on the 25 ppm rate. On August 7, 2015, Ms. Pitrolo responded that she was unaware of the AQRV analysis that had been conducted in 1999 at the higher NOx limitation of 42 ppm and therefore, based on that and the other information NCDAQ provided, the Forest Service would not be requesting any additional analysis to assess potential impacts to James River Face Wilderness (see correspondence in Appendix C)

Neither a Class 1 SIL analysis nor a Class 1 Increment analysis was conducted since 1-hour NO_2 values have not yet been established for either one.

6.6 PSD Air Quality Modeling Result Summary

Based on the PSD air quality ambient impact analysis performed, the proposed Duke-Rockingham facility will not cause or contribute to any violation of the Class 1I NAAQS, PSD increments, Class 1 Increments, or any FLM AQRVs.

7.0 Permit Changes

The following changes were made to the Duke Energy Carolinas LLC Rockingham County Combustion Turbine Facility Air Permit No. 08731T14:

Page	Section	Description of Changes
Cover	--	Amended permit numbers and dates.
12	2.1.A.3.a.i, footnote a	Added Section 2.1 A.3.a.i.(C) to the exceptions from complying with the nitrogen oxide BACT limits.
12	2.1.A.3.a.i, footnote b	Added that the 24-hour rolling average applies unless otherwise noted and that periods measured in accordance with 2.1.A.3.a.i.(A), (B) or (C) are not included in determining the 24-hour rolling average.
12	2.1.A.3.a.i.(A)	Revised to separate requirements for startup and shutdown from periods of malfunction for emissions allowed above the short-term nitrogen oxide BACT limits. Added that the ppmvd limits are at 15% O_2 and are based on a 1-hour rolling average (these are not new requirements).
12	2.1.A.3.a.i.(C)	Added this condition for emissions of nitrogen oxides when operating at an ambient temperature of less than or equal to 32ºF and firing natural gas.
13	2.1.A.3.b	Removed "except as allowed under 2.1 A.3.a.i.(A) and (B)" from the noncompliance statement: "If the results of this test are above the limit given in Section 2.1 A.3.a.i, above, except as allowed under 2.1 A.3.a.i.(A) and (B), the Permittee shall be deemed in noncompliance…" since subsections (A) and (B) are included in Section 2.1 A.3.a.i and are therefore already covered by the noncompliance statement.
14	2.1.A.3.h	Revised to show separate monitoring noncompliance requirements for excess short-term or long-term nitrogen oxide emissions for various operating conditions.

Page	Section	Description of Changes
14	2.1.A.3.j.ii	Revised to show separate reporting requirements for excess short-term nitrogen oxide emissions for various operating conditions.
15	2.1.A.3.j.iv	Added this condition to report the full load equivalent hours for each turbine when operating at an ambient temperature of less than or equal to 32ºF and firing natural gas.
15	2.1.A.3.j.v	Added this condition to report the total long-term annual nitrogen oxide emissions (tons per rolling consecutive 12-month period) from all turbines.
29-37	3.0	Updated general conditions to version 4.0 12/17/15

8.0 Public Participation

The application is being processed using the procedure in 15A NCAC 02Q .0501(d)(1), satisfying the permitting requirements in both 15A NCAC 02D .0530 "Prevention of Significant Deterioration" and 2Q .0500 "Title V Procedures".

The public notice will provide for a 30-day comment period with an opportunity for a public hearing. Copies of the public notice will be sent to persons on the Title V mailing list and EPA. Pursuant to 15A NCAC 02Q .0522, a copy of the permit application and the proposed permit (in this case, the draft permit) will be provided to EPA for their 45-day review. Also pursuant to 02Q .0522, a notice of the draft Title V Permit will be provided to each affected State at or before the time notice provided to the public under 02Q .0521 above. A copy of the final permit will also be provided to the EPA upon issuance as per 02Q .0522.

In accordance with 40 CFR 51.166(q*), Public participation,* the reviewing authority (NCDAQ) shall:

1. **Make available in at least one location in each region in which the proposed source would be constructed a copy of all materials the applicant submitted, a copy of the preliminary determination, and a copy or summary of other materials, if any, considered in making the preliminary determination.**

   These materials will be available at the Winston-Salem Regional Office located at 450 West Hanes Mill Road, Winston-Salem, NC 27105, phone number (336) 776-9800.

2. **Notify the public, by advertisement in a newspaper of general circulation in each region in which the proposed source would be constructed, of the application, the preliminary determination, the degree of increment consumption that is expected from the source or modification, and of the opportunity for comment at a public hearing as well as written public comment.**

   Pursuant to 15A NCAC 02Q .0307, the public notice of the draft permit will be published in the Greensboro News & Record on February 1, 2016 to provide for a 30-day comment period with an opportunity for a public hearing. Appendix B contains a copy of the public notice.

3. **Send a copy of the notice of public comment to the applicant, the Administrator and to officials and agencies having cognizance over the location where the proposed construction would occur as follows: Any other State or local air pollution control agencies, the chief executives of the city and county where the source would be located; any comprehensive regional land use planning agency, and any State, Federal Land Manager, or Indian Governing body whose lands may be affected by emissions from the source or modification.**

   The public notice will be sent via email (US mail for the Rockingham County Manager) to the affected parties.

4. **Provide opportunity for a public hearing for interested persons to appear and submit written or oral comments on the air quality impact of the source, alternatives to it, the control technology required, and other appropriate consideration.**

   The public notice provides for the opportunity to request a public hearing for the modification.

5. **Consider all written comments submitted within a time specified in the notice of public comment and all comments received at any public hearing(s) in making a final decision on the approvability of the application. The reviewing authority shall make all comments available for public inspection in the same locations where the reviewing authority made available preconstruction information relating to the proposed source or modification.**

   The NCDAQ will consider all timely comments submitted. All documents related to this determination, including comments received, will be available as public records at both the Regional Office and the Central Office.

6. **Make a final determination whether construction should be approved, approved with conditions, or disapproved.**

   After completion of the public notice process of the draft permit, NCDAQ will issue a final determination regarding the change.

7. **Notify the applicant in writing of the final determination and make such notification available for public inspection at the same location where the reviewing authority made available preconstruction information and public comments relating to the source.**

   The applicant will be informed of the final determination via a revised permit. All documents related to this determination, including comments received, will be available as public records at both the Regional Office and the Central Office.

Appendix E includes a mail listing of entities and associated materials to be sent for this proposed PSD major modification application, satisfying the requirements in §51.166(q) “public participation”.

9.0 Other Requirements

<u>PE Seal</u>
Not applicable, no controls are being added.

<u>Zoning</u>
There is no expansion of the facility, therefore zoning consistency is not needed.

<u>Fee Classification</u>
The facility fee classification before and after this modification will remain as “Title V”.

<u>Increment Tracking</u>
NOx emissions increase due to the increase from 15 ppmvd to 25 ppmvd when burning natural gas at ambient temperatures less than or equal to 32ºF. Duke requested up to 2,000 hours per year for the alternate NOx limit of 25 ppm. However, as previously discussed, NCDAQ has reduced the alternate limit to no more than 500 hours per year.

The current potential NOx emissions from each combustion turbine at 15 ppmvd are 104 lb/hr. Therefore, the potential increase of 10 ppmvd (from 15 ppmvd to 25 ppmvd) results in a total hourly increase of:

104 lb/hr x 10 ppmvd/15ppmvd x 5 turbines = 346.7 lb/hr

There is no change to PM-10 or sulfur dioxide emissions from this modification.

10.0 Recommendations

Based on the application submitted and review by the NCDAQ, the NCDAQ is making a preliminary determination that the modification can be approved and a permit issued. A final determination will be made following public notice and comment and consideration of all comments.

APPENDIX A

Draft Permit

APPENDIX B

Public Notice

APPENDIX C

Siemens Original Data Sheet

APPENDIX D

Correspondence Attachments

Date/Subject	Addressed To	From
April 21, 2014 (email – included with May 15, 2015) Notification of proposed PSD project	Class I Federal Land Managers various	Tom Anderson AQAB
May 15, 2014 (email) No Class I analysis needed pending refined emissions	Ed Martin NCDAQ	Tom Anderson/FLM AQAB
December 1, 2014 (letter) Approval of modeling protocol	Cynthia Winston Duke	Tom Anderson AQAB/NCDAQ
January 12, 2015 (letter) Application deemed complete as of December 12, 2014	Glenn Harris Duke	Ed Martin NCDAQ
March 9, 2015 (email) Application sent to EPA	Lorinda Shepherd EPA	Mark Cuilla NCDAQ
April 14, 2015 (memo) Modeling review for 1-hour NO_2 NAAQS completed	Ed Martin NCDAQ	Tom Anderson AQAB
April 29, 2015 (email) Received EPA's comments on the application	Tom Anderson AQAB	Stan Krivo EPA
June 11, 2015 (letter) Proposed PSD Project (with application)	Bill Jackson James River Face FLM	Ed Martin NCDAQ
July 20, 2015 (email) Proposed PSD Project follow-up inquiry	Bill Jackson James River Face FLM	Ed Martin NCDAQ
July 20, 2015 (email – included with August 7, 2015) Hourly NOx emissions increase for the project	Melanie Pitrolo James River Face FLM	Ed Martin NCDAQ
July 21, 2015 (email – included with August 7, 2015) Hourly NOx emissions increase for the project	Ed Martin NCDAQ	Melanie Pitrolo James River Face FLM
July 30, 2015 (email – included with August 7, 2015) Anticipated consecutive hours of operation	Melanie Pitrolo James River Face FLM	Ed Martin NCDAQ
August 3, 2015 (email – included with August 7, 2015) Anticipated consecutive hours of operation	Ed Martin NCDAQ	Melanie Pitrolo James River Face FLM
August 7, 2015 (email) Forest Service does not need any additional analysis	Melanie Pitrolo James River Face FLM	Ed Martin NCDAQ
September 8, 2015 (email) Requested changes to the application	Ed Martin NCDAQ	Cynthia Winston Duke
September 22, 2015 (letter) Amendment to application	Lawrence Sparks Rockingham Station Manager	Ed Martin NCDAQ

Date/Subject	Addressed To	From
September 29, 2015 (email) Requested additional cost information for BACT analysis	Cynthia Winston Duke	Ed Martin NCDAQ
October 7, 2015 (email) Received additional cost information for BACT analysis	Ed Martin NCDAQ	Cynthia Winston Duke
November 10, 2015 (email) Additional information request	Cynthia Winston Duke	Ed Martin NCDAQ
November 13, 2015 (email) Amendment to application	Ed Martin NCDAQ	Lawrence Sparks Rockingham Station Manager
November 19, 2015 (email) Additional information request	Cynthia Winston Duke	Ed Martin NCDAQ
December 1, 2015 (email) Response to Additional information request	Ed Martin NCDAQ	Larry Sparks Rockingham Station Manager

APPENDIX E

Mail Listing

	Letters	Email
APPLICANT	Mr. Lawrence Sparks, Station Manager Rockingham Simple Cycle Station 864 South Edgewood Road Eden, NC 27288	Larry.Sparks@duke-enerty.com
WINSTON-SALEM REGIONAL OFFICE	Mr. Robert Barker 450 West Hanes Mill Road, Suite 300 Winston-Salem, NC 27105	robert.barker@ncdenr.gov
EPA	Ms. Ceron Heather Air Permits Section U.S. EPA Region 4 Sam Nunn Atlanta Federal Building 61 Forsyth Street, S.W. Atlanta, Georgia 30303-3104	ceron.heather@epa.gov shepherd.lorinda@epa.gov
COUNTY MANAGER	Mr. Lance L. Metzler Rockingham County Manager P.O. Box 101 Wentworth, NC 27375	Public Notice
NEWSPAPER	Classified Ads	Public Notice

Attachments to Emails
rockingham_permit_T15_alt_cold_weather_NOx_BACT
rockingham_review_T15_alt_cold_weather_NOx_BACT
rockingham_review_T15_appendix_C_and_D
public notice
4 Letters (above)